

## Environmental Qualification of Dimpled Ball Grid Arrays for Space Flight Applications

### **Abstract**

With smaller and smaller Printed Wiring Board (PWB) form factors, such as CompactPCI<sup>®</sup>, the need for smaller packages with high I/Os has grown significantly. Thus, the use of Ball Grid Array packages have become necessary for space flight applications. A Jet Propulsion Laboratory/NASA technology and system development program that services various spacecraft missions uses a 3U CompactPCI<sup>®</sup> form factor. The System Input/Output board requires a large amount of I/Os and has limited area, so conventional packages, such as quad flat packs will not fit. Kyocera's 472 Dimpled Ball Grid Array (D-BGA) package was chosen for this application. Since this type of package has not been used in past space flight environments, it was necessary to determine the robustness and reliability of the solder joints. The D-BGAs were qualified by developing assembly, inspection and rework techniques as well as environmental tests. The test article was a printed wiring assembly (PWA) consisting of four daisy chained D-BGA packages. Visual inspection of the outer solder joints and real time X-ray were used to verify solder quality prior to testing. The test article was electrically monitored for shorts and opens at or above 1  $\mu$ s during all environmental tests. Three environmental tests were conducted: random vibration at 0.2  $g^2/Hz$ , pyro shock at 2000g, and thermal cycling from -55°C to 100°C. After testing, Scanning Electron Microscope (SEM) analysis was performed on various D-BGA cross sections to determine the quality of the package-to-board interface. The Kyocera 472 D-BGA packages passed the above environmental tests within the specifications and are now qualified for use on space flight electronics.